

**Before the
Federal Communications Commission
Washington, DC 20554**

In the matter of

Unlicensed Operation in the TV Broadcast Bands)	
)	ET Docket No. 04-186
Additional Spectrum for Unlicensed Devices)	
Below 900 MHz and in the 3 GHz Band)	ET Docket No. 02-380

Comments of Josephson Engineering, Inc.

Josephson Engineering is a small manufacturer of microphones and provider of engineering services based in Santa Cruz, California with customers worldwide. The company does not make wireless microphones at present but its consulting practice has included a wide range of radio-frequency projects over the past 30 years. The author of this comment is also chair of the Audio Engineering Society Standards Committee Working Group SC-04-04 on Microphone Characteristics, although the AES is not a party to this comment.

Summary

Josephson strongly supports the action of the Commission to make more spectrum available for unlicensed wireless devices. With the proper safeguards, it will be possible both to protect incumbent users and to foster development of new devices and services. We are concerned that some of the technical approaches considered are unduly complex and may not solve the problems addressed, and offer some suggestions on alternatives. We believe that the proposed rules could enable a whole new range of wireless-enabled devices and hope that the Commission will look beyond the concerns of the parties immediately involved today and see the broadest possible application of the proposed rules. Our points in brief are:

- Personal/portable devices transmit only when enabled by fixed/access transmitters
- Channel availability database should be maintained by any qualified party
- Protecting construction permits as well as licenses makes update period longer
- Existing FCC registration can be used to identify systems
- “Hidden node problem” makes spectrum avoidance impractical in this application
- Separate provisions should be made for very low power autonomous devices

Unlicensed Use

In general we support the conclusions in the NPRM.¹ Low power uses of vacant TV spectrum such as biomedical telemetry and wireless microphones have developed without significant impact to television reception over many years. Recent proposals such as the expansion of the UNII bands and the addition of 3650-3700 MHz to the possibilities for unlicensed operation have opened many alternatives for the “downlink” or base-to-subscriber channel. There remains a requirement for “uplink” and ad-hoc channel use, and as other commenters have noted, vacant TV spectrum is uniquely suited for some of these applications. There is also an opportunity to address a long-standing inequity in the wireless microphone spectrum allocations.

System Design

There are principally two types of wireless communications systems discussed in this proceeding. One is where the personal/portable wireless device is used in conjunction with a fixed/access device, which may be licensed or not. The other is an autonomous system in which personal/portable devices are transmit without supervision. We believe that the Commission’s proposal to allow personal/portable devices to transmit only when notified of channel availability by a fixed/access device is in general the best approach. Autonomous devices should also be permitted whenever it can be shown that no interference would be caused to licensed operations.

Interference Avoidance

In the new rules permitting operation on 5470-5725 MHz,² active avoidance of incumbent signals is practical only because, being monostatic radars, the receivers being protected from interference are colocated with the transmitters the unlicensed device must monitor. This scenario is unreliable whenever the path to the incumbent transmitter is different from the path to the protected receiver, and we would urge the Commission not to permit this approach. We support the approach of checking the fixed/access device location against a channel availability database as proposed.

There is a significant delay between the issuance of a TV construction permit and actual occupancy of the frequency. Rather than asking for daily checks of the database and advocating that it be kept up to date on actual channel use, monthly or bimonthly checks should be sufficient if the database were to include protection for construction permits as well as operational stations.

The maximum range of personal/portable transmitters, given the power and antenna requirements proposed, is around 1 km. It should be possible to require that fixed/access

¹ *Notice of Proposed Rulemaking*, in ET Dockets 04-186 and 02-380, FCC 04-113 (rel. May 25,2004)

² *Report and Order*, in ET Docket 03-122, FCC 03-287, 69 Fed. Reg. 2677-2688 (January 20, 2004)

devices be inside the area defined in the channel availability database by at least that distance, plus the uncertainty of position determination.

Many unlicensed systems would operate entirely indoors where GPS reception is impossible. Therefore, while it should be an option for outdoor fixed/access transmitters, the Commission should not mandate the use of GPS.

The concept of a time-limited “lease” on channel availability might be included. This would permit automatic operation over periods where connectivity to the database or GPS propagation were interrupted. For instance, the shortest practical time between issuance of a TV construction permit and operation might be 30 days. Therefore a personal/portable transmitter might be assigned a frequency by its associated fixed/access device, which assignment was valid until 30 days after the fixed/access device had last been updated from the channel availability database.

While it is always possible for a determined adversary to spoof a system into granting access on unauthorized terms, if it’s designed to be sufficiently open this shouldn’t be a problem. If the device manufacturers must comply with certification requirements, and fixed/access device operators must also identify their transmissions in order for the personal/portable transmitters to function, this should be sufficient protection.

Channel Availability Database

The Commission recently transferred the administration of cellular system identification numbers to private industry.³ We suggest that a similar approach be taken to allow any interested and qualified party to sign a memorandum of understanding and perform the function of maintaining a channel availability database. The memorandum should require that the database be updated within 7 days of the issuance of a construction permit.

We agree with the concept of reserving one or two channels in each metropolitan area for licensed wireless microphone users, and suggest that the Commission continue to recognize the Society of Broadcast Engineers as the coordinator for these frequencies. The SBE should be asked to designate which channels should be reserved in each area and so inform the parties maintaining the channel availability database.

System Registration

Assigning the fixed/access device responsibility for controlling the personal/portable device is probably the simplest way to assure that operation only takes place on vacant frequencies. Equipment certification requirements can assure that some form of control exists, whether by automatic location determination and consultation of a database or professional installation.

We suggest that operators of fixed/access devices be required to register with the Commission (using the existing FRN/CORES database, for instance) and identify by

³ *Public Notice*, DA 03-2760 (August 29, 2003)

using this registration number together with a unique, factory-assigned identifier. Any personal/portable transmitter would transmit the registration number of the associated fixed/access device, plus its own unique identifier which was assigned by the manufacturer. In this way any transmission would be identifiable as to hardware and operator. The fixed/access device would not necessarily be operating in the TV bands; such control could be accomplished by any means including licensed or unlicensed transmissions otherwise permitted, or wired connection⁴ but would be certified as part of the system that enabled the personal/portable device to function. The operator would be responsible for maintaining records of the procedures it employed to assure that the fixed/access transmitters and any personal/portable stations associated with them were operating on frequencies available in the area. These could include manual checks of the channel availability database or automatic, location-aware updates. The means to comply with this requirement would be supplied by the equipment manufacturer and in the case of professional installer checking, be part of the users manual which is reviewed during certification.

Professional Installer and Location Requirements

If the operators of fixed/access transmitters are responsible for frequency assignment to unlicensed personal/portable transmitters, it will be in their interest to employ means to insure compliance with the frequency availability rules, just as PCS mobile telephone licensees maintain control of their unlicensed subscriber sets⁵. We suggest that fixed/access operators be required to maintain records, available for inspection by the Commission or any TV licensee, of its system configuration. This file would include model numbers of fixed/access transmitters, and if such transmitters required professional installation, records of the installation, location determination and database checks.

The position of protected TV contours is not realistically known to a resolution of better than about 1 km, therefore requiring positional accuracy of 10 m seems excessive. It should be permissible to operate as close to the boundary of the channel availability database as the positional accuracy permits.

It should not require any special certification to determine location of a fixed/access device to within 1 km and program such information into it. The operators of such devices should be responsible to authorize only such installers as they are confident can perform this task.

Very Low Power Autonomous Operation

The Commission has an opportunity with this proceeding to address a long-standing inequity in the wireless microphone rules. At present, entities producing content for broadcast, cinema and cable operations are the only ones eligible for licensing in the

⁴ One-way transmitters might receive their channel assignment while temporarily connected to fixed/access devices. This method is commonly used by manufacturers of cordless phones to comply with the code-assignment requirement of §15.214.

⁵ FCC Rules, Part 15, Subpart D (§22.319 et seq.)

UHF wireless microphone channels. Live music, legitimate theater, and other religious and business entities are only permitted to use eight frequencies in the 170 MHz range.

The proposed rules would allow personal/portable transmitters to operate with 100 mW peak output into a 6 dBi gain antenna, or 400 mW peak EIRP. It would certainly be possible to use this provision to operate wireless microphones, which could receive their channel assignment “lease” when their internal batteries were recharged at the fixed/access device. However, wireless microphones typically operate with much lower power and typically with an approximately isotropic antenna. We recommend that provision be made in the rules for operation of autonomous devices not exceeding 100 mW peak EIRP with non-detachable antennas, with operator-selectable frequency assignment as is the case with FCC-certified licensed wireless microphones.

Just as we have recommended that one or two channels be set aside in each metropolitan area for licensed wireless microphones, we suggest that the SBE be asked to designate the same number of channels for unlicensed wireless microphones. The channel availability database should indicate these reservations. Since most of these operations occur indoors, we believe that the potential for interference to licensed operations is minimal. There is also a significant incentive for the operators of such very low power devices to seek out the reserved channel for such operations in each area in order to avoid potential interference from higher power devices operating in conjunction with fixed/access units.